

Patent Claims

1. Apparatus for determining and/or monitoring volume- and/or mass-flow of a medium (3) flowing through a pipeline (2) in a stream direction (S), comprising: At least two ultrasonic sensors (16, 17), which are secured in a defined measuring positional relationship on the outer wall of the pipeline (2) and which alternately emit and receive ultrasonic measuring signals; and a control/evaluation unit (22), which determines volume- and/or mass-flow of the medium (3) in the pipeline (2) on the basis of a travel time difference of the ultrasonic measuring signals in the stream direction (S) and opposite to the stream direction (S);

characterized in that

the two ultrasonic sensors (16, 17) are secured on a pliers-like clamping unit (4), which is embodied in such a manner that the ultrasonic sensors (16, 17) are bringable into the measuring positional relationship by clamping onto the pipeline (2).

2. Apparatus as claimed in claim 1, characterized in that

the pliers-like clamping unit (4) is so embodied that the two ultrasonic sensors (16, 17) are automatically brought, by the clamping onto the pipeline (2), into the measuring positional relationship, largely independently of the outer diameter of the pipeline (2).

3. Apparatus as claimed in claim 1 or 2, characterized in that

the clamping unit (4) is embodied in such a manner that the two ultrasonic sensors (16, 17) are arranged in the measuring positional relationship in a two, or more, traverse arrangement on a surface element (32) essentially parallel to the longitudinal axis (31) of the pipeline (2).

4. Apparatus as claimed in claim 1 or 2, characterized in that the clamping unit (4) is embodied in such a manner that the two ultrasonic sensors (16, 17) are arranged in the measuring positional relationship on opposing sides of the pipeline (2) in a one-traverse arrangement or in a multiple one-traverse arrangement.

5. Apparatus as claimed in claim 1 or 2, characterized in that the clamping unit (4) comprises a first portion (28) and a second portion (29).

6. Apparatus as claimed in claim 5, characterized in that the first portion (28) comprises two lever arms (5, 6), which are coupled with one another in mid-regions thereof via a pivot connection (7).

7. Apparatus as claimed in claim 5, characterized in that the second portion (29) includes components as follows: Two guide rails (10, 11) arranged in V-shape and coupled together in connected end regions via a pivot connection (9); two securely-clampable pivot connections (10, 23; 21, 24) provided in free end regions of the guide rails (10, 11) and in end regions of a transverse member (12); two connecting pieces (14, 15), on which the ultrasonic sensors (16, 17) are secured; the transverse member (12), which is rigidly connected with the first lever arm (5) of the first portion (28); and a holder (19), which is connected with the second lever arm (6) of the first portion (28).

8. Apparatus as claimed in claim 1, 6 or 7, characterized in that

a first rotation transmitter (25) is provided, which determines the angle between the two lever arms (5, 6), wherein the control/evaluation unit (22) determines, on the basis of the determined angle between the two lever arms (5, 6) the outer diameter (D_a) of the pipeline (2).

9. Apparatus as claimed in claim 1, 6 or 7, characterized in that at least one additional ultrasonic sensor (34) is provided, which determines wall thickness (d) of the pipeline (2).

10. Apparatus as claimed in claim 9, characterized in that a compensating unit (18, 19) is provided, which automatically compensates for the thickness (d) of the pipe wall of the pipeline (2) by corresponding height displacement (H) of the pliers-like clamping unit (4).

11. Apparatus as claimed in claim 10, characterized in that assigned to the compensating unit (18, 19) are a second rotation transmitter (26) and a length sensor (27), via which influence of the pipe wall on travel time of the ultrasonic measuring signals is automatically taken into consideration.